IBM Flex System PCIe Expansion Node

IBM Redbooks Product Guide

The IBM® Flex System™ PCIe Expansion Node provides the ability to attach additional PCI Express cards, such as High IOPS SSD adapters, fabric mezzanine cards, and next-generation graphics processing units (GPU), to supported IBM Flex System compute nodes. This capability is ideal for many applications that require high performance I/O, special telecommunications network interfaces, or hardware acceleration using a PCI Express GPU card. The PCIe Expansion Node supports up to four PCIe adapters and two additional Flex System I/O expansion adapters.

Figure 1 shows the IBM Flex System PCIe Expansion Node attached to an IBM Flex System x240 Compute Node.

Figure 1. IBM Flex System PCIe Expansion Node (right) attached to an x240 Compute Node (left)

Did you know?

The PCIe Expansion Node is ideal for application environments that are written to take advantage of acceleration and visualization performance using GPUs that are connected to Flex System Compute nodes. It is also useful for environments that require specific PCIe adapter connectivity to a Flex System Compute node.

Part number information

Table 1. Ordering part number and feature code

Description	Part number	Feature code
IBM Flex System PCIe Expansion Node	81Y8983	A1BV

The part number includes the following items:

- IBM Flex System PCIe Expansion Node
- Two riser assemblies
- Interposer cable assembly
- Double-wide shelf
- Two auxiliary power cables (for adapters that require additional +12V power)
- Four removable PCIe slot air flow baffles
- Documentation CD that contains the *Installation and Service Guide*
- Warranty information and Safety flyer and Important Notices document

Supported servers

The IBM Flex System PCIe Expansion Node is supported when it is attached to the IBM Flex System compute nodes listed in Table 2. Only one Expansion Node can be attached to each compute node.

Table 2. Supported servers

Expansion card	Part number	x220	x240	x440	p24L	p260	p460
IBM Flex System PCIe Expansion Node	81Y8983	Y*	Y*	N	N	N	N

* The PCIe Expansion Node requires that both processors be installed in the x220 and x240.

Features

The PCIe Expansion Node has the following features:

- Support for up to four standard PCIe 2.0 adapters:
  - Two PCIe 2.0 x16 slots that support full-length, full-height adapters (1x, 2x, 4x, 8x, and 16x adapters supported)
  - Two PCIe 2.0 x8 slots that support low-profile adapters (1x, 2x, 4x, and 8x adapters supported)
- Support for PCIe 3.0 adapters by operating them in PCIe 2.0 mode
- Support for one full-length, full-height double-wide adapter (consuming the space of the two full-length, full-height adapter slots)
- Support for PCIe cards with higher power requirements

  The Expansion Node provides two auxiliary power connections, up to 75W each for a total of 150W of additional power using standard 2x3, +12V six-pin power connectors. These connectors are placed on the base planar so that they both can provide power to a single adapter card (up to 225W), or to two adapters (up to 150W each). Power cables are used to connect from these connectors to the PCIe adapters and are included with the PCIe Expansion Node.
- Two Flex System I/O expansion connectors

  The I/O expansion connectors are labeled I/O expansion 3 connector and I/O expansion 4 connector in Figure 2. These I/O connectors expand the I/O capability of the attached compute node.

The layout of the PCIe Expansion Node is shown in Figure 2. The four PCIe slots are routed through two riser connectors on the system planar.

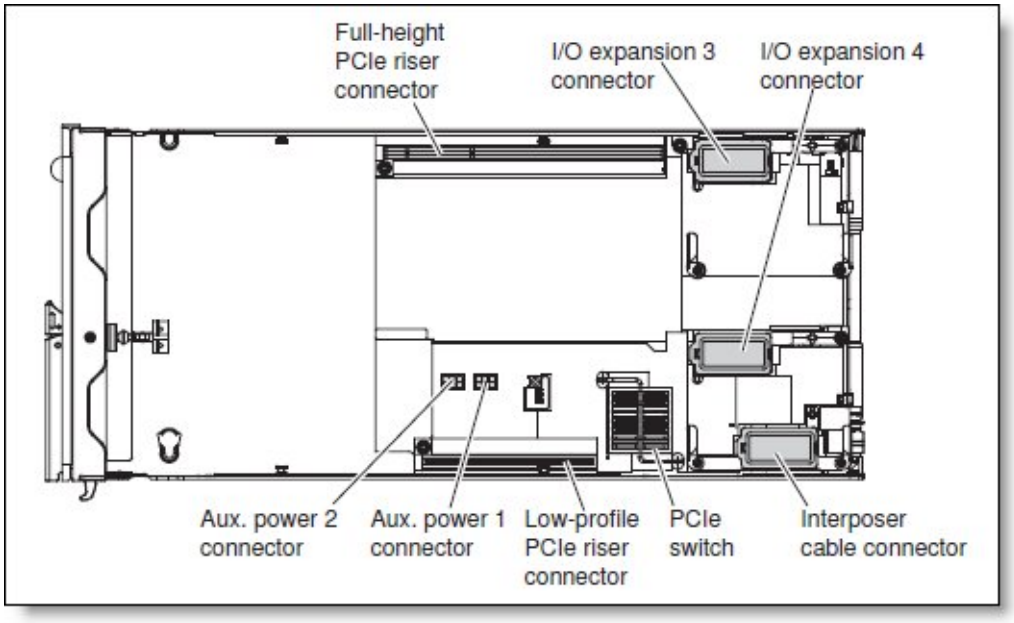

Figure 2. Layout of the PCIe Expansion Node

Architecture

Figure 3 shows the architecture of the PCIe Expansion Node when connected to a compute node.

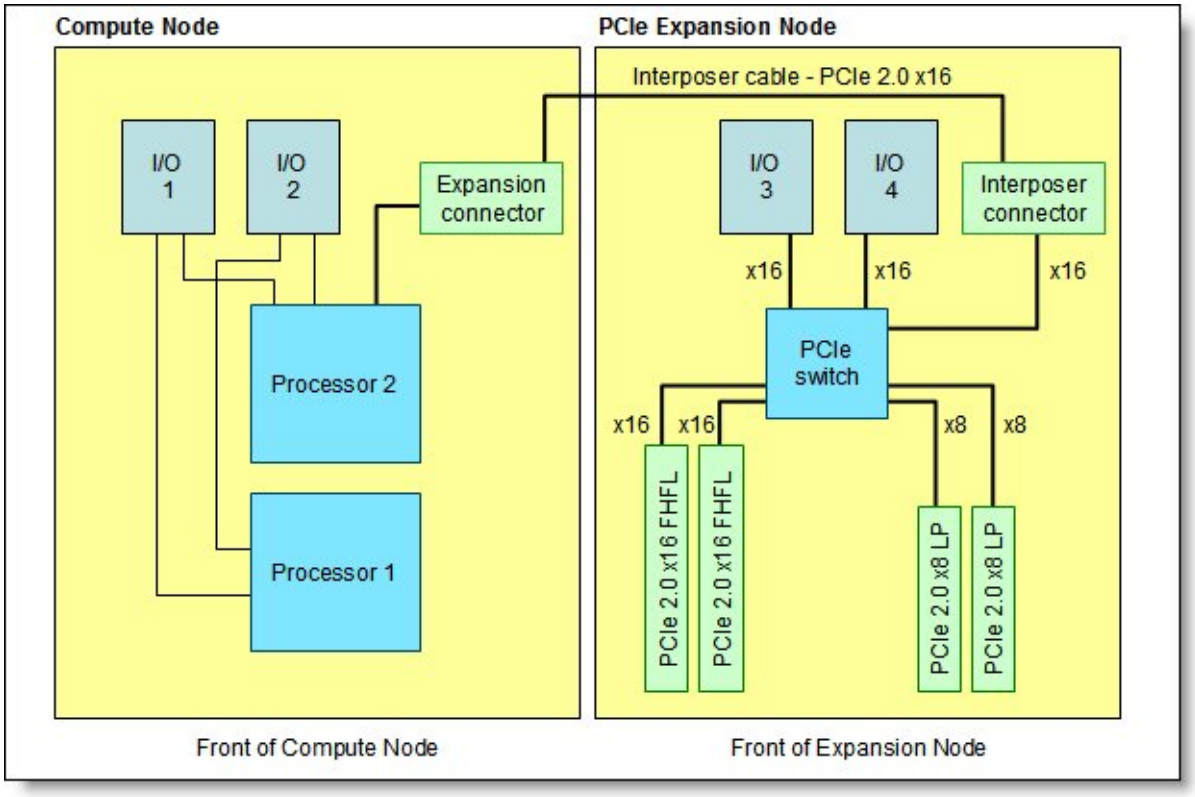

Figure 3. Architecture of the PCIe Expansion Node

The Expansion Node connects to a standard-width compute node using the interposer cable which plugs into the expansion connector and interposer connector on the compute node and Expansion Node respectively. This link forms a PCIe 2.0 x16 connection between the compute node and the PCIe switch in the Expansion Node. The PCIe switch has connections to the six PCIe slots in the Expansion Node:

- PCIe 2.0 x16 connections to the two full-length full-height PCIe slots
- PCIe 2.0 x8 connections to the two low-profile PCIe slots
- PCIe 2.0 x16 connectors to the two Flex System I/O expansion slots (labeled I/O 3 and I/O 4 in the figure).

Notes:

- In compute nodes, such as the x220 and x240, I/O expansion slot 1 and 2 in the server operate at PCIe 3.0 speeds. However, I/O expansion slots 3 and 4 in the PCIe Expansion Node (and also the four standard PCIe slots) operate at PCIe 2.0 speeds.
- The expansion connector in the compute node is routed through processor 2. Therefore, processor 2 must be installed in the compute node.

When adapters are installed in the two I/O expansion slots, they connect to the chassis midplane and provide additional connections to I/O module bays in the chassis. Table 3 shows the connections between the expansion slots and the module bays. Note that the ports available from the adapter vary, depending on whether the adapter is a 2-port or 4-port adapter. Similarly, the number of ports to the I/O module depend on the number of ports activated in the switch.

Table 3. Adapter-to-I/O bay correspondence

I/O expansion slot	Port on the adapter	Corresponding I/O module bay in the chassis
Slot 1 (Compute Node)	Port 1	Module bay 1
	Port 2	Module bay 2
	Port 3*	Module bay 1**
	Port 4*	Module bay 2**
Slot 2 (Compute Node)	Port 1	Module bay 3
	Port 2	Module bay 4
	Port 3*	Module bay 3**
	Port 4*	Module bay 4**
Slot 3 (Expansion Node)	Port 1	Module bay 1
	Port 2	Module bay 2
	Port 3*	Module bay 1**
	Port 4*	Module bay 2**
Slot 4 (Expansion Node)	Port 1	Module bay 3
	Port 2	Module bay 4
	Port 3*	Module bay 3**
	Port 4*	Module bay 4**

* Ports 3 and 4 require that a four-port card be installed in the expansion slot.
** Might require one or more port upgrades to be installed in the I/O module.

Supported PCIe adapter cards

The Expansion Node supports the following general adapter characteristics:

- Full-height cards, 4.2 in (107 mm)
- Low-profile cards, 2.5 in (64 mm)
- Half-length cards, 6.6 in (168 mm)
- Full-length cards, 12.3 in (312 mm)
- Support for up to four low-profile PCIe cards
- Support for up to two full-height PCIe cards
- Support for up to one full-height double-wide PCIe card
- Support for PCIe standards 1.1 and 2.0 (PCIe 3.0 adapters supported operating in PCIe 2.0)

The front-facing bezel of the Expansion Node is inset from the normal face of the compute nodes. This inset is to allow for the use of cables connected to PCIe adapter cards that support external connectivity. The Expansion Node provides up to 80 mm of space in the front of the PCIe adapter cards to allow for the bend radius of these cables.

Table 4 lists the PCIe adapters that are supported in the Expansion Node. Some adapters must be installed in one of the full-height slots as noted. If the NVIDIA Tesla M2090 is installed in the Expansion Node, then an adapter cannot be installed in the other full-height slot. The low-profile slots and Flex System I/O expansion slots can still be used, however.

Table 4. Supported adapter cards

Description	Part number	Feature code	Maximum supported
640GB High IOPS MLC Duo Adapter (full-height adapter)	81Y4519	5985	2
1.28TB High IOPS MLC Duo Adapter (full-height adapter)	81Y4527	A1NB	2
IBM 1.2TB High IOPS MLC Mono Adapter (low-profile adapter)	90Y4377	A3DY	4
IBM 2.4TB High IOPS MLC Duo Adapter (full-height adapter)	90Y4397	A3DZ	2
NVIDIA Tesla M2090 (full-height adapter)	94Y5960	A1R4	1*

* if the NVIDIA Tesla M2090 is installed in the Expansion Node, then an adapter cannot be installed in the other full-height slot. The low-profile slots and Flex System I/O expansion slots can still be used.

Consult the IBM ServerProven® site for the current list of adapter cards that are supported in the Expansion Node:
http://ibm.com/systems/info/x86servers/serverproven/compat/us/flexsystems.html

For information about the IBM High IOPS adapters, see the following IBM Redbooks® Product Guide:
http://www.redbooks.ibm.com/abstracts/tips0729.html

Note: Although the design of Expansion Node allows for a much greater set of standard PCIe adapter cards, the preceding table lists the adapters that are specifically supported. If the PCI Express adapter that you require is not on the ServerProven web site, use the IBM ServerProven Opportunity Request for Evaluation (SPORE) process to confirm compatibility in the desired configuration.

Supported I/O expansion cards

Table 5 lists the Flex System I/O expansion cards that are supported in the PCIe Expansion Node.

Table 5. Supported I/O expansion cards

Description	Part number	Feature code
IBM Flex System CN4054 10Gb Virtual Fabric Adapter	90Y3554	A1R1
IBM Flex System CN4054 Virtual Fabric Adapter (SW Upgrade)	90Y3558	A1R0
IBM Flex System EN2024 4-port 1Gb Ethernet Adapter	49Y7900	A10Y
IBM Flex System EN4132 2-port 10Gb Ethernet Adapter	90Y3466	A1QY
IBM Flex System IB6132 2-port FDR InfiniBand Adapter	90Y3454	A1QZ
IBM Flex System FC5022 2-port 16Gb FC Adapter	88Y6370	A1BP
IBM Flex System FC3172 2-port 8Gb FC Adapter	69Y1938	A1R0
IBM Flex System FC3052 2-port 8Gb FC Adapter	95Y2375	A2N5

Consult the IBM ServerProven site for the current list of adapter cards that are supported in the Expansion Node:
http://ibm.com/systems/info/x86servers/serverproven/compat/us/flexsystems.html

For information about these adapters, see the IBM Redbooks Product Guides for Flex System in the Adapters category:
http://www.redbooks.ibm.com/portals/puresystems?Open&page=pg&cat=adapters

Physical specifications

Dimensions and weight (approximate):

- Height: 56 mm (2.2 in)
- Depth: 489 mm (19.25 in)
- Width: 217 mm (8.6 in)
- Maximum weight: 5.4 kg (11.9 lb)

Shipping dimensions and weight (approximate):

- Height: 240 mm (9.5 in)
- Depth: 680 mm (26.8 in)
- Width: 601 mm (23.7 in)
- Weight: 9.5 kg (21 lb)

Operating environment

When the unit is powered on, it is supported in the following environment:

- Temperature: 5° C to 40° C (41° F to 104° F)
- Humidity, noncondensing: -12° C dew point (10° F) and 8% - 85% relative humidity
- Maximum dew point: 24° C (75° F)
- Maximum altitude: 3048 m (10,000 ft)
- Maximum rate of temperature change: 5° C/hr (41° F/hr)

Regulatory compliance

The unit conforms to the following standards:

- ASHRAE Class A3
- FCC - Verified to comply with Part 15 of the FCC Rules Class A
- Canada ICES-004, issue 3 Class A
- UL/IEC 60950-1
- CSA C22.2 No. 60950-1
- NOM-019
- Argentina IEC 60950-1
- Japan VCCI, Class A
- IEC 60950-1 (CB Certificate and CB Test Report)
- China CCC (GB4943); (GB9254, Class A); (GB17625.1)
- Taiwan BSMI CNS13438, Class A; CNS14336
- Australia/New Zealand AS/NZS CISPR 22, Class A
- Korea KN22, Class A, KN24
- Russia/GOST ME01, IEC 60950-1, GOST R 51318.22, GOST R
- 51318.249, GOST R 51317.3.2, GOST R 51317.3.3
- IEC 60950-1 (CB Certificate and CB Test Report)
- CE Mark (EN55022 Class A, EN60950-1, EN55024, EN61000-3-2,
- EN61000-3-3)
- CISPR 22, Class A
- TUV-GS (EN60950-1/IEC 60950-1, EK1-ITB2000)

Related publications

For more information, see the following resources:

- IBM US Announcement Letter
  http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS112-139
- IBM Flex System product page
  http://ibm.com/systems/flex
- IBM Flex System Information Center
  http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp
- IBM ServerProven hardware compatibility page for IBM Flex System
  http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/
- *IBM Flex System x240 Compute Node, IBM Redbooks Product Guide*
  http://www.redbooks.ibm.com/abstracts/tips0860.html
- *IBM Flex System x220 Compute Node, IBM Redbooks Product Guide*
  http://www.redbooks.ibm.com/abstracts/tips0885.html

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